

THE COST OF ACUTE BURN PATIENTS TREATED IN A MOROCCAN INTENSIVE BURN CARE UNIT

COÛT DE LA PRISE EN CHARGE DES PATIENTS BRÛLÉS UN SERVICE DE SOINS INTENSIFS SPÉCIALISÉ

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SUMMARY. Eighty-five percent of burns occur in low- and middle-income countries, but reports on the cost of burn treatment in these countries are still rare. It is important for patients, their families, the government, society and insurance companies to be aware of the costs of burn treatment. Burn care in specialized burn units requires trained doctors and staff, specialist equipment, facilities, special tissue banks and specific dressings, and is thus very expensive. Burn care in Morocco is not as expensive as in other countries but nonetheless proves to be a high financial burden for patients, their families and the wider society. In this report we comprehensively calculate almost all the direct costs of managing in-hospital acute burns. The mean burn cost per patient in our country is US\$ 16 975. We also compare the results of treatment with other reports. In this way, governmental and burn hospital authorities can have a better estimation of the direct costs of a burn center and the total budget that may be required for the whole country to cover the annual costs of treating burn patients.

Keywords: healthcare costs, cost of burn care, burn care, cost analysis, health economics

RÉSUMÉ. Alors que 95% des brûlures surviennent dans les pays à IDH bas ou moyen, les données concernant le coût de leur prise en charge restent rares. Il est important pour les patients, leurs familles, les gouvernements et les sociétés d'assurance de connaître ce paramètre. Les soins aux brûlés dans les unités spécialisées nécessitent du personnel médical et non médical qualifié, des infrastructures, des équipements et du matériel spécifiques, une banque de peau, investissements très lourds. Bien que moins chère que dans d'autres pays, la prise en charge des brûlés au Maroc représente une charge financière importante pour les patients, leur famille, la société entière. Nous avons calculé la quasi-totalité des coûts directs d'une hospitalisation en service de soins intensifs aux brûlés, qui est en moyenne de 16 975\$ et l'avons comparé aux données de la littérature. Ceci permet au gouvernement et aux directeurs d'hôpitaux de modéliser le budget nécessaire au fonctionnement d'un centre de traitement des brûlés, afin de l'abonder et de prévoir l'enveloppe nécessaire à la prise en charge des brûlés à l'échelle du pays.

Mots-clés : coûts de santé, coût de la prise en charge d'un brûlé, analyse médico-économique

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Introduction

Amongst those involved in burns care, there has always been a consensus that the costs of treatment of burns patients are high. Patients with burns will suffer pain, both physical and emotional, from the moment of injury. But the cost of injury does not end there. Dressing changes, operations, rehabilitation and psychological counselling are just some aspects of treatment that these patients must endure.

During this, there is time lost from work, spent away from family and from studies, and lost opportunities as life outside their injury goes on. The flow-on effects of a significant burn are devastating – not only for the patients themselves, but also for their loved ones.

It is impossible to attempt to measure these ‘true’ costs of a burn. We can attempt to understand and calculate one aspect of cost however - the financial burden of treatment.

Burns are one of the most common forms of injury in our country. In a list of the greatest causes of burden from disease or injury, burns rank seventh place. Our center is the largest burn hospital in Morocco and acts as the main referral center for the south of the country. We have about 50 admissions each year. The present study focuses on the economic and financial burden of burns.

Eighty-five percent of burns occur in low- and middle-income countries but reports on the cost of burn treatment in these countries are still rare. It is important for the patients, their families, the government, society, and the insurance companies to be aware of the costs of burn treatment. Burn care in specialized burn units requires trained doctors and staff, specialist equipment, facilities, special tissue banks and specific dressings, and is thus very expensive. Burn care in Morocco is not as expensive as in other countries but nonetheless proves to be a high financial burden for patients, their families and the wider society.

The public healthcare system protection system covers all employees for sickness, maternity, invalidity and retirement. Since 2005, all Moroccan citizens are required to be members of a basic medical scheme, AMO (mandatory health insurance), via their local branch split into two sections - CNSS (private) and

CNOPS (public). The most needy have access to a Medical Assistance Scheme (RAMED). This scheme is based on the principle of social welfare and national solidarity. It allows persons who are not paying into the AMO to benefit from treatment dispensed in public medical centres as well as state-provided health services. AMO covers a broad range of health services like general medicine and medical and surgical specialties, pregnancy, childbirth and post-natal care, laboratory tests, radiology and medical imaging, but patients are required to pay for their oral treatment and necessary medical and paramedical treatment for surgery or wounds that is not available in hospitals.

The Moroccan healthcare system has four layers, the first being “primary healthcare”. This includes clinics, health centres and local hospitals for public healthcare, and infirmaries and medical offices for private healthcare. The second section includes provincial and prefectural hospitals for public health, and specialised clinics and offices for private health. The third area includes hospitals in all major cities, and the fourth includes university hospitals. These centres have the most advanced equipment.

In this report we comprehensively calculate almost all the direct costs of managing in-hospital acute burns. We also compare the results of treatment with other reports. In this way, burn costs are compared according to the results of treatment. Governmental and burn hospital authorities can have a better estimation of the direct costs of a burn center and the total budget that may be required for the whole country to cover the annual costs of treating burn patients.

Material and methods

Population/study location

This is a prospective study including all patients consecutively admitted to intensive care beds (ICU) at a specialized center for the treatment of burns from February 2019 to February 2020. The exclusion criteria were intubated patients <24h, age <5 years and admissions for causes other than acute burns. The study was conducted in a public university hospital serving a geographic region with an estimated population of 8 025 927 habitants and is a

public university referral hospital with 586 beds. The Burn Unit consists of 6 intensive care beds and one operating room.

Over the one-year study period, we treated 300 burn patients, 53 of whom required hospital admission. All patients admitted with acute burns in the study period were included in this investigation. We kept financial files on the patients to calculate the cost of burn care, including the cost of all medications and medical consumables, dressing material, hospital fees, investigations, lab tests, OT costs, blood products, dietary costs, hospital administrative costs and so on.

The government and ministry of health fund the costs of establishing the hospital, the equipment, salaries of doctors, residents, nurses and staff, and therefore these were not included in the calculation of patient charges. Afterward, staff salaries were calculated, and then the total cost of treatment with salaries was calculated.

Burn unit and management protocols

The department has 6 beds dedicated to acute burns. During the study period the burn unit was staffed with 3 Professors, 7 Residents, 1 Physiotherapist (with some students) and 9 Nurses. In addition there were separate staff members for burn theatre, including anaesthetists. Each burn patient is nursed in an isolated cubicle. The entire burn unit is air-conditioned. Intravenous fluid resuscitation, topical therapy (silver sulphadiazine) with daily dressing change, routine blood investigations, bacteriological monitoring and good nutrition are highlights of the treatment protocol. Dressings for most of the patients are carried out by resident doctors. There are arrangements for patients to shower as and when required. From the total number of patients admitted during the study period, their average length of stay and the total expenditure during the study period, we have calculated the average cost of treatment per day, per patient.

After admission, all patients were given intravenous fluid resuscitation, topical antibiotic therapy (silver sulfadiazine) with daily dressing changes, routine blood investigations, bacteriological monitoring, and burn wound excision and skin grafting, good nutrition, intensive physiotherapy and rehabilitation.

Cost evaluation

The direct costs related to the daily clinical and surgical treatment of the study patients until hospital outcome were evaluated. Costs were grouped into five blocks: clinical support, drugs and blood products, medical procedures, specific burn procedures and hospital fees. The clinical support block included laboratory tests, complementary examinations, imaging examinations and nutrition. The drugs and blood products block included drugs, blood and blood products. The medical procedures block included costs related to personnel providers: nonspecific surgical procedures performed by plastic surgeons, anaesthetic procedures and materials specific to intensive care. The specific burn procedures block included costs related to personnel providers (plastic surgeons) performing specific procedures (hydrotherapy, bed dressings, debridement, autologous grafts and escharotomies). The hospital fees block included daily ICU intensivist salaries and daily hospitalist physician salaries. Costs related to the use of equipment, infrastructure, electricity, security systems, information technology, non-clinical support, salaries of personnel providers other than physicians and indirect costs (loss of productivity, etc.) were not analyzed.

Therefore, these values are close to the real amount of money a hospital would have to pay for these variables. Subsequently the values were translated into US dollars (US\$) based on the average price of the currency for the year 2020.

Results

During the study, we treated a total of 53 burn patients admitted for hospital stay. Sixty-four percent of our patients were male and 36% female. The male to female ratio was 1:77. Burns caused by open flame were the most frequent (64%) followed by scalds (28%), electrical burns (7%) and chemical burns (1%). Close to 85% of patients did have basic insurance cover. Mean hospital stay was 15 days. The length of hospital stay was shown to increase in line with the increased size of the burn area ($p<0.02$) and infection ($p<0.01$). The mean TBSA of our patients was 25%. Skin graft surgery was carried out

in 11% of the patients. A total of 62.2% of our patients developed signs of burn wound infection and received burn wound biopsy and tissue culture. Of these patients, 50% had positive culture results. The most common bacteria found in burn wound cultures were: enterobacter cloacae (14%), acinobacter baumannii (13%) and staphylococcus aureus (13%).

The mortality rate progressively increased with the increase in burn area; mortality was 9%.

Cost estimation methodology

A bottom up costing approach was used. Medications and medical consumables including the dressing material used for the patients during the study period were recorded from indent registers, and the cost of the same was obtained from the purchase section of the hospital. Patient case records provided the information on investigations requisitioned and the blood products transfused. The salaries of the doctors, nursing staff, and other paramedical/ancillary staff were computed for the study period for the burn unit as well as the dedicated burn theatre. A patient mortality rate of 9% was identified, while 4% of patients were discharged at their own request (against the physician's advice), 70% were discharged with partial recovery and 5% with complete recovery. During follow-up, we had only one mortality, which was unrelated to the burn injury. We examined the financial files of the patients. The mean cost of burn treatment for every patient was US\$ 16 975. The mean cost for a one-day stay in hospital was US\$ 1131.

Those with infections had a longer stay in hospital and therefore their additional costs are expressed as more days in hospital, namely an extra US\$ 19 per day. The mean cost of treatment for one patient was US\$ 33,696, the mean per day was US\$ 1150.

Discussion

Burn injury is one of the most devastating and disabling traumas for a human being. Burns are still very frequent in our country and result in a high mortality and morbidity rate. Usually, burns occur in low socioeconomic populations, meaning that the cost of burn treatment is very important for patients, their families,

the government and insurance companies. Hospital charges and costs associated with further treatment post-discharge have a great impact on the psychosocial situation of the patients. In 2013, Mirastschijski¹ reported a cost of US\$ 351,000 (270,000 euros) per patient per annum for treatment of burn-related complications. Ahuja,² also in 2013, reported the cost of providing inpatient burn care in a tertiary teaching hospital to be about US\$ 1,060 for every patient in India. It thus appears that the costs of treating burns in Europe and South Africa are higher than in Morocco, whereas they are lower in India and Iran. However, the impact of burn cost of treatment per country compared to their gross national income per capita and gross domestic product (GDP) in *Table I* shows that burn cost in Morocco is higher than in Turkey and Iran, who have better GNI per capita and GDP that can be explained by expansive human resources. For India, even with an important GDP, the 1.3 billion population makes its GNI per capita less important than the Moroccan one.

Comparisons of the mortality rates of the burn centers in these countries with our own treatment outcomes can tell us about the efficacy and quality of their procedures.

Table I - Burn cost per country and their GNI and GDP

Country	Average cost in US\$	GNI per capita in US\$ ¹⁰	GDP in US\$million ¹¹
USA (Bilir) ³	301 516,00	65,760	21,433,226
Switzerland (Mehra) ⁴	167 353,00	85,500	703,082
Australia (Ahn) ⁵	73 532,00	54,910	1,396,567
Brazil (Anami) ⁶	39 594,00	9,130	1,839,758
Morocco (Our study)	16 975,00	3,190	119,700
Turkey (Sahin) ⁷	15 250,00	9,610	761,425
Iran (Karimi) ⁸	2 810,00	5,420	445,345
India (Ahuja) ²	1 060,00	2,130	2,868,929
Malawi (Gallaher) ⁹	559,00	380	7,667

Burn injuries usually occur among low and medium socio-economic populations. The average wage for basic workers in our country for the period under assessment was roughly US\$ 3000 per year. It is obvious, therefore, that the cost of burn treatment for even a single patient (mean = US\$ 16 975) is a huge financial burden on the family.

Dressing costs are 40 US\$ for every 1% of skin surface burned. This is twice the average for the Indian study of Ahuja² of 87 US\$, which is a developing country like ours but where costs remain significantly lower than in developed countries, particularly Great Britain with 333 US\$ per dressing, as reported in the Hemington-Gorse study.¹²

Staff is the first expense (51%), which is consistent with the 70% reported in India² but not with Malawi,⁹ where it is only 16%, which can be explained by the fact that salaries are relatively low in this part of the world.

We acknowledge some difficulties encountered for a proper estimation of burn cost due to the lack of centralized financial billed charges data at the hospital. We were able to make estimations on usage and direct and indirect cost but the inconsistency of supply availability and funding presents a number of challenges for an accurate cost analysis. We mitigated this with researched estimates by locating as much historical monthly usage data as possible and by consulting with providers in the unit. We addressed the variability in resource availability by estimating ideal but realistic resource utilization, but some important burns patients need more care than others, which means more time and more healthcare workers around the patient.

Data from our burn register program will facilitate health authorities in developing measures to decrease the incidence and hospitalization prices of burn patients. Burn injuries are preventable, provided a community-specific intervention program is enforced with a robust instructional element. In this study, we tend to look at knowledge about the legal status of single or unmarried patients, who are also likely to suffer from loneliness, depression and money issues. However, this variable wasn't shown to have an impact on the result or hospital costs of the patients. The patients' level of education was conjointly reviewed as

an indication of their socioeconomic standing. Again, this data wasn't found to have an important impact on the costs related to the burn injury.

Our review of the information of the cost showed that roughly two-thirds of the patients were discharged and therefore might have had money issues. This class of patients needs to be facilitated by government or charity organizations. For this reason, health authorities need to try to cut back burn patient costs and reduce the prices of any discharged patients. Intervention programs and academic transmission may additionally facilitate in scaling back the quantity of burn patients. The information from our register will facilitate health authorities in forecasting the economic costs of burns and budget consequently. Moreover, in order to reduce the cost of burn care, conventional closed methods should be switched with cheaper dressing methods like moist exposed burn ointment¹³ It may also assist with the promotion of measures to decrease the cost of treatment through sanctioning cost comparisons over many years, and across various burn centers in Morocco. This might lead to the unfolding of newer and higher treatments that are more efficient for burn patients.

Conclusion

The cost of burn treatment in Morocco is lower than in the USA and Europe (developed world), with acceptable and comparable mortality rates. The mean burn cost per patient in our country is US\$ 16 975.

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